

## **2019 Annual Report**

to the USDA Forest Service under Sponsor Award

#19-DG-11031600-052 for 2019 (NAU Projects 1004033-1004038)



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## **Summary**

This report presents an integrated and coordinated series of actions for \$1.5 million awarded to the ERI in Fiscal Year 2019 under CFDA 10.694, Southwest Forest Health and Wildfire Prevention. The information provided herein comprises the final report for 2019 deliverables under 19-DG-11031600-052 (NAU 1004033-1004038).

All of the activities (deliverables) summarized in this report respond to land manager and stakeholder requests and needs. The deliverables are informed by best available science and scientific evidence which is translated into the language and product appropriate for the target audience. The ERI actively delivers information using a variety of approaches that includes individual and group presentations and discussions, to printed and electronically accessible fact sheets, short technical reports, longer white papers and management reports, and peer reviewed archival literature.

The Ecological Restoration Institute at Northern Arizona University is grateful for the funding that the United States Forest Service has provided for these efforts.

**FY19 Deliverables (Final) – #19-DG-11031600-052**

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## FY19 Deliverables (Final) – #19-DG-11031600-052

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| <p><b><i>Project 1. Science Delivery and Support for Collaborative Restoration and Conservation from the Local to the Landscape Scale</i></b></p>   |
| <p><b>1.1 Science delivery and support for the Four Forest Restoration Initiative (4FRI), a Collaborative Forest Landscape Restoration Act project.</b></p>   |
| <p>1.1a: The ERI serves in leadership positions on the 4FRI Steering Committee, Rim Country EIS Working Group, and Comprehensive Implementation Working Group.</p> <p><u>Deliverable:</u> Report on leadership activities (stakeholder group and working groups).</p> <p>Diane Vosick – Co-chair of 4FRI Stakeholder Group, April–November 2019<br/> Amy Waltz – Co-chair of 4FRI Rim Country DEIS Working Group, July 2019–June 2020. <i>(Key deliverable for FY 2019: Stakeholder group comments on the Rim Country DEIS)</i><br/> Bryce Esch – Co-chair of 4FRI Multi-Party Monitoring Board, July 2019–June 2020<br/> Melanie Colavito – Co-chair of CFLRP Renewal, August 2019–January 2020<br/> Taylor Dubay – Chair of Communications Working Group, August 2019–ongoing</p>               |
| <p>1.1b: The ERI will work with the 4FRI Multi-Party Monitoring Board (MPMB) and Monitoring Coordinator to monitor and assess the initial task orders implemented under the 1st analysis area EIS with respect to 4FRI desired conditions. Remote sensing tools and plot-based metrics will be assessed and analyzed for adaptive management needs.</p>   |
| <p>1.1b.i: <u>Deliverable:</u> Monitoring report that includes an analysis of ground plot pre- and post-vegetation data.</p> <p>The anticipated monitoring report was not completed because no post-treatment data were collected in summer 2019 by the 4FRI MPMB. Bryce Esch is currently transitioning monitoring data leadership and data analyses work to the Landscape Conservation Initiative, a contractor hired by the Forest Service 4FRI Team to monitor data collection and to better institutionalize 4FRI monitoring.</p>  |
| <p>1.1b.ii: <u>Deliverable:</u> Presentation of monitoring results to the 4FRI Stakeholder Group (SHG) and Forest Service 4FRI team. Dependent on 1.1bi, above.</p> <p>Esch, B.E. Presentation of 4FRI plot-based monitoring pre-treatment data to 4FRI Forest Service team and Multi-Party Monitoring Board. Nov. 19, 2019. <i>(Note: this completed an FY18 deliverable, Project 1.1b.ii)</i></p> <p>Webinar/Meeting presentation. Hosted by 4FRI Stakeholder Group meeting. Title: “Monitoring status to the 4FRI Stakeholder Group,” May 27, 2020. Attendees: 65. Coordinated by Bryce Esch, who also presented the ground-plot protocol and information to date. Other information presented included remote sensing data, passerine bird and goshawk monitoring, and stream monitoring.</p> |

1.1c: The ERI provides administrative and IT support to facilitate effective collaborative operations. Deliverable: Report on IT support for the 4FRI website and BASECAMP (an online collaborative work space) and administrative support, including minutes and agendas.

Norton, H. Ongoing. Maintains all website support.  
Covington, C. Monthly management of all administrative tasks related to the Stakeholder Group meetings. This includes: agendas, minutes, meeting scheduling coordination, and BASECAMP.  
Monthly management of Steering Committee calls. This includes: agendas, minutes, and coordination.

## **1.2 CFLRP ten-year report and workshop.**

1.2a: Deliverable: Contributions to the National Indicators Monitoring Project.

A. Waltz participated in a national team, led by USDA National CFLRP Coordinator Lindsay Buchanan, that designed and collected the indicator report. Participated in 6–8 meetings, reviewed data and [final report](#).

Waltz, A. CFLRP Ecological Indicator Reports Peer Learning Session. Presenter for National Forest Foundation Peer Learning Webinar. Oct. 24, 2019. 70 attendees. Recorded [here](#).

1.2b: Deliverable: Workshop for CFLRP stakeholders and land managers with pilots in the Intermountain West. This deliverable is in cooperation with CFRI and NMFWR.

Waltz, A.E.M, B.E. Esch, and M.M. Colavito. Cross-Boundary Landscape Restoration Workshop. Southwest Ecological Restoration Institutes. March 2–4, 2020. Workshop. 150 attendees

## ***Project 2. Evaluation and Synthesis of Best Available Scientific Information (BASI) for Landscape Restoration West-Wide***

### **2.1 Synthesis of best available science on either a) restoration treatment effectiveness with expected climate change; or, b) landscape metrics that detect change in western forests — are we meeting landscape planning goals?**

2.1a: Deliverable: Synthesis of best available science on a topic to be determined based on preliminary analysis. **\*\*Deliverable changed** with the opportunity to partner with multiple authors on two West-wide science syntheses with University of Washington colleagues (see citations below).

Hagmann, R.K., et al. *In Review*. Evidence for widespread changes in structure, composition, and fire regimes of western North American forests. (*Manuscript will be submitted to peer-reviewed journal Ecological Applications.*)

Prichard, S.J., et al. *In Review*. Adapting western US forests to wildfires and climate change: Ten misconceptions. (*Manuscript will be submitted to peer-reviewed journal Ecological Applications.*)

2.1b: Deliverable: Presentation at a professional conference or to stakeholder group or practitioners.

The FY19 presentation on the regeneration deliverable for FY18 Project 2.1 (T. Wasserman) was not completed due to scheduling difficulties with national forest partners due to COVID-19 priorities. However, an earlier presentation of this paper to the 4FRI team and stakeholders in FY18 (December 2019) contributed to FY19 conversations that resulted in changing how regeneration would be accounted for in the Rim Country EIS.

### ***Project 3. Monitoring, Evaluation, and Adaptive Management of Landscape Restoration in Western Fire-Adapted Forests and Woodlands***

#### **3.1 Long-term Ecological Assessment and Restoration Network (LEARN).**

3.1a: Deliverable: Technical report on Centennial Forest remeasurement.

Manuscript for publication – draft completed, to be submitted to *Forest Ecology and Management* by November/December 2020.

- Huffman, D.W., M.T. Stoddard, J.P. Roccaforte, J.D. Springer, and A.J. Sánchez Meador. Restoration treatment effects on structure and within-stand heterogeneity in southwestern ponderosa pine forests  
(Draft manuscript is included in this document, click [here](#).)

3.1b: Deliverable: Technical report on LEARN cross-network analysis of treatment responses.

Manuscript for publication – draft completed, to be submitted to *Forest Ecology and Management* journal by December 2020.

- Stoddard, M.T., J.P. Roccaforte, A.J. Sánchez Meador, and D.W. Huffman. Ponderosa pine restoration treatments promote long-term ecological resilience in Arizona, USA  
(Draft manuscript is included in this document, click [here](#).)

3.1c: Deliverable: Progress report on Gus Pearson Natural Area (GPNA) 25-year remeasurement.

In FY19, the ERI continued long-term monitoring of the GPNA study site. Understory cover data were collected on all plots (n = 65). Litter samples were collected from 20 stations, and fuels data were collected on two transects for each of the 65 plots. Photos were taken on 65 plots.

3.1d: Deliverable: Progress report on Mogollon Rim mixed-conifer project.

Implementation of the long-term study is still pending. In FY19, the ERI maintained contact regarding implementation with the Coconino National Forest and Salt River Project. Several phone calls and emails were exchanged, and interest in implementation remains high for all stakeholders. We are hoping that a cooperative arrangement between Coconino National Forest, SRP, and the ERI will lead to implementation in the near future.

### 3.2 Landscape analyses of restoration treatments and climate.

3.2a: Deliverable: Technical report on managed wildfire spatial analysis.

Manuscript for publication – draft completed, to be submitted to *Landscape Ecology* by the end of October 2020.

- Donager, J., A.J. Sánchez Meador, and D.W. Huffman. Comparisons of landscape metrics in managed wildfire and reference ponderosa pine forests of northern Arizona  
(Draft manuscript is included in this document, click [here](#).)

3.2b: Deliverable: Progress report on understanding ponderosa pine ecotone dynamics.

Click [here](#) to view enclosed progress report on understanding ponderosa pine ecotone dynamics.

*Summary*: This study will use remote sensing data and ground-truth plots to examine changes in ponderosa pine forest cover below the Mogollon Rim and identify primary factors (climate changes, wildfire, forest treatments) related to change. Assessment will include cover of old-growth stands and individual trees.

3.2c: Deliverable: Technical report on landscape metrics of restoration success — developing adaptive management guidelines by measuring metric sensitivity among different treatment types.

Waltz, A.E.M., J. Donager, C.S. Stotts, A.J. Sánchez Meador, and B.E. Esch. 2020. [An Evaluation of Spatial Structure in the Ft. Valley Restoration Blocks and the Pre-Treatment 4FRI Chimney Springs Project Area](#). ERI Technical Report. Ecological Restoration Institute, Northern Arizona University. 15p.

### 3.3 Analysis of monitoring data.

3.3a: Deliverable: Technical report on managed wildfire effects on herbaceous communities.

Manuscript for publication – draft completed, to be submitted to *Forests* by mid-December 2020.

- Springer, J.D., M.T. Stoddard, D.W. Huffman, D.C. Laughlin, P.Z. Fulé, and M.L. Daniels. Plant community responses to wildfires managed for multiple objectives across an elevational gradient on the North Rim of Grand Canyon National Park, Arizona, USA  
(Draft manuscript is included in this document, click [here](#).)

3.4a: Deliverable: Progress report on a northern Arizona mixed-conifer demonstration in partnership with the Coconino National Forest for stakeholder and elected official learning purposes.

No progress made. A northern Arizona mixed-conifer demonstration site is needed to educate local stakeholders, local and state elected officials, and other land management agency partners. A location off of Snowbowl Road was suggested by the Flagstaff Ranger District, as having already completed NEPA that would allow for some demonstration units. However, the latest Mexican spotted owl data have modified Protected Activity Centers (PACs) that will result in necessary changes to that NEPA, and limit the ability to do mixed-conifer restoration demonstrations. With much of northern Arizona's mixed conifer in areas with limited access, this demo site has been difficult to realize.

**Project 4. Understanding and Solving the Economic, Social, and Political Issues and Opportunities of Ecological Restoration**

**4.1 Facilitate implementation of the high-priority efficiency and modernization actions identified for testing during 4FRI implementation.**

4.1a: Deliverable: Coordination of quarterly webinars.

Colavito, M., and D. Vosick. Accelerating Restoration Implementation Webinar. Partnering with 4FRI Implementation Team and The Nature Conservancy. Aug. 14, 2019. 13 attendees. Group refocused to planning and support and re-oriented to support workshop planning.

4.1b: Deliverable: A workshop in fall 2019 that is designed in cooperation with the Forest Service to discuss lessons learned from the 4FRI implementation of modernization actions.

Colavito, M., and D. Vosick. "Modernizing 4FRI Implementation Workshop: Progress After Two Years." Ecological Restoration Institute, The Nature Conservancy, USDA Forest Service 4FRI Team, and USDA Forest Service FPM Team. October 29–30, 2019. High Country Conference Center, Flagstaff, AZ. 110 attendees

4.1c: Deliverable: Report summarizing workshop discussion.

Vosick, D., and M. Colavito. 2020. [Modernizing 4FRI Implementation: Progress After Two Years](#). ERI Workshop Report. Ecological Restoration Institute, Northern Arizona University. 21 p.

**4.2 Inventory how wildfire risk assessment and treatment prioritization models are being used to inform restoration and all-lands management planning and implementation in the West.**

4.2a (and 4.2b\*): Deliverable: A report summarizing what wildfire risk assessment and treatment prioritization decision support tools are in use by Forest Service planners and implementation staff, how they are being developed and used, what barriers and facilitators exist to their use, recommendations for when and where they are most appropriate, and what education and training strategies are needed to increase use. Presentation to appropriate staff of the Forest Service, AZ Department of Fire and Forest Management (DFFM), and New Mexico Energy, Minerals, and Natural Resources Department (EMNRD).

*\*Note: Project 4.2a and 4.2b reports merged into a single report deliverable. The language stated above combines the two reports from the original work plan into one. The Colavito (2020) report (see citation below) is final and is enclosed in this report as a PDF (click [here](#) to view). However, the report will not be published to the ERI e-library, as a manuscript based on this report is being developed for peer review. The final report will be uploaded and published to the ERI e-library when the publication has been accepted by a journal.*



Technical report

Colavito, M.M. 2020. The Role of Risk Management Prioritization Decision Support Tools: An Overview of Barriers, Facilitators, and Recommendations. ERI Technical Report. Ecological Restoration Institute, Northern Arizona University. 47 p.

Presentation

Presentations of the report's findings were delayed due to Covid-19 safety concerns and interruptions. A webinar has been scheduled in partnership with the Southwest Fire Science Consortium for Dec. 8, 2020. Additional presentations are forthcoming at the time of this report.

***Project 5. Improving Forest Operations and Biomass Utilization***

**5.1 Staff support for testing and evaluating improvements to forest operations and biomass utilization.**

5.1a: Deliverable: Report describing staff support.

The ERI Forest Operations and Biomass Utilization team performs research and development activities to improve the efficiency of in-woods operations and the utilization of wood and biomass resulting from restoration thinning treatments. Federal funding in Project 5 is used to support some of the administrative and professional services needed for Forest Operations and Biomass Utilization program activities.

The following list provides details on work performed in FY19:

1. Gradeability and soil impacts of mechanized steep slope operations.
2. Analyzing log scaling tickets to assess log transportation efficiency.
3. Wood and biomass supply analysis for production of wood-plastic composite products and torrefied briquettes.
4. Opportunities and barriers for Arizona to supply wood fiber to South Korean renewable energy markets.
5. [Chip & Ship](#): Testing the logistics of supplying wood chips over long distances using intermodal railroad transportation.

***Project 6. Science Delivery and Outreach to National, Western, and Southwestern Audiences: Federal, State, Tribal, and Private Forestry***

**6.1 Provide support to federal land managers with science synthesis, technical assistance, rapid assessments, learning workshops, and presentations.**

6.1a: Deliverable: Report on actions to deliver science to support project assessments, data collection, treatment design, and use of best available science by federal land managers.

6.1a.i: Deliverable: A combination of ten (10) total services based on previous and anticipated demand that may include: workshops, information requests, technical assistance, field trips, and presentations.

1. Stotts, C. "The Pinaleño Ecological Restoration Project and Demonstration Unit: Effects of restoration treatment and wildfire in a mixed-conifer forest." Safford Ranger District staff meeting, Coronado National Forest. Aug. 5, 2019. 25 participants. *Presentation*.
2. Stotts, C. Technical assistance and partner participation in Boulin Resource Objective Wildfire, Alex Spannuth, fire ecologist, Kaibab National Forest. Aug. 19, 2019. *Technical assistance*.
3. Stotts, C. Shaula Hedwall from US Fish and Wildlife Service request for "The Pinaleño Ecological Restoration Project and Demonstration Unit: Effects of restoration treatment and wildfire in a mixed-conifer forest" report. Aug. 28, 2019. *Information request*.
4. Stotts, C. Micah Kiesow, soil scientist on Kaibab National Forest, requested list of pinyon-juniper papers. Provided with D. Huffman support on Aug. 28, 2019. *Information request*.
5. Stotts, C. Chris Guiterman, Forest Stewards Guild requested Bluewater Restoration Demo data, for New Mexico data compilation. Sept. 10, 2019. *Information request*.
6. Stotts, C. Technical assistance to Kaibab National Forest on prescribed fire as FEMO technician, request by Alex Spannuth. Provided Oct. 6, 2019. *Technical assistance*.
7. Esch, B. Structuring Adaptive Management for the Long-term. Presentation at 2020 Cross-boundary Landscape Restoration Workshop. March 3, 2020. 150 attendees. *Presentation*.
8. Esch, B., T. Wasserman, and A. Waltz. Request from Jack Triepke to assist with R3 Climate Adaptation Strategy development. October 2019 and ongoing. *Technical assistance*.
9. Waltz, A., B. Esch, and T. Wasserman. Coordination call with Dave Petersen, Jessica Halofsky, PNW Research, to coordinate R3 Climate Adaptation Strategy Workshop opportunity. With Jack Triepke. Prospectus for 2020 project developed. Feb. 13, 2020. *Needs assessment*.
10. Waltz, A., and D. Huffman. Science delivery with Kaibab National Forest's Ariel Leonard and Micah Kiesow. Meeting to scope out rapid assessment needs for 2019 and workshop needs in 2020. March 9, 2020. *Needs assessment*.

11. Waltz, A. Support to Dick Fleishman, 4FRI, for 4FRI National Indicator reporting. Expert review and additions to 4FRI reporting for Washington Office National Indicator. Dec. 11, 2019. *Technical assistance.*
12. Esch, B. RIMC Monthly Calls — Region 3 partner report-outs and expert advice to Washington Office for support to adaptive management and monitoring guidance. Monthly, July 2019–June 2020. *Technical assistance.*
13. Waltz, A. Support to P. Moore, 4FRI silviculturist. How to frame 4FRI openness metrics for monitoring and adaptive management; addressing science gaps and availability. Shared literature on openness by T. Wasserman, A. Sánchez Meador, D. Churchill, by J. Cannon, and Y. Dickinsen. Sept. 2 and Sept. 10, 2019. *Technical assistance.*
14. Waltz, A., D. Huffman, and ERI Science Delivery staff. Meeting with Jacob Lopez and fire staff on Flagstaff Ranger District. Museum Fire needs assessments: questions from Forest Service potentially addressed by existing plot layout in Dry Lakes Hills. For 2020 workplan development. Oct. 11, 2019. *Needs assessment.*
15. Waltz, A. Call with Mary Lata, fire ecologist, Tonto National Forest. Update on PODs project on the Tonto, capture landscape strategic needs, and delivery of D. Huffman managed fire paper. Oct. 11, 2019. *Needs assessment.*
16. Esch, B. Provided 4FRI collaborative database, developed by ERI, to Chris Stroble, director of Forest Service Enterprise Data Warehouse (EDW), as per Jamie Barbour request. Feb. 18, 2020. *Information request.*
17. Waltz, A. Participant/information provider for USDA Forest Service Washington Office call requested by Jamie Barbour with Chris Stroble, director of EDW. Subject: to discuss collaborative, multi-party data storage in Forest Service institutional databases. Feb. 20, 2020. *Information request.*
18. Waltz, A. Meeting with Nick Wilhlemi, Forest Service Pest and Pathogen specialist. Planning for 2019 RAP on mistletoe, and scoping for 2020 mistletoe demonstration area. Feb. 28, 2020. *Needs assessment.*
19. Waltz, A. Call with Jim Youtz for needs assessment of San Juan Canyon — proposed rapid assessment for 2020 work plan. March 5, 2020. *Needs assessment.*
20. Waltz, A. Call with Thad Chavez and Christina Barba, San Bernadino National Forest (Region 5) for needs assessment of Big Bear Project. Science needs scoping or appropriate partner hand-off for 2020 work plan. March 12, 2020. *Needs assessment.*
21. Wasserman, T. Discussion with John Bradford on USGS work on climate change and forests, and other ongoing USGS projects for 2019–2020 Project 2 work plan scoping. September 2019. *Needs assessment.*
22. Wasserman, T. Conversations with Megan Friggens on R3 climate change work and RMRS perspective work relating climate change from 2019–2020 Project 2 work plan scoping. September 2019. *Needs assessment.*
23. Wasserman, T. Discussion with Patrick Moore on the need for info on historical openings and groups and how to approach restoration. Expert opinion provided. December 2019. *Information request.*

24. Waltz, A., and J. Springer. Request for Arizona Strip plant guides; delivered spreadsheet and mailed Northern Arizona Plant Guide. Greta Hyland, fuels specialist, Arizona Strip District, BLM. March 2020. *Information request.*
25. Waltz, A. Participant/information provider for USDA Forest Service Washington Office call requested by Jamie Barbour with Forest Service Ecosystem Management Coordination and regional monitoring leads. Subject: to discuss collaborative, multi-party data storage in Forest Service *data.gov*. April 12, 2020. *Information request.*
26. Esch, B., with A. Waltz, D. Huffman, and M. Stoddard. Field trip with Tusayan Ranger District, Kaibab National Forest to review ERI past research, pinyon-juniper classification and management options. Tusayan Ranger District, two stops. June 10, 2020. 5 Forest Service attendees (No more than 10 in field at a time per Forest Service COVID-19 protocol). *Field trip.*
27. Curran, S. Database assistance to National Park Service. Nov. 22, 2019. *Technical assistance.*

6.1a.ii: Deliverable: Present two (2) webinars in partnership with the Southwest Fire Science Consortium and/or National Forest Foundation to present emerging science to land managers and practitioners. This outreach was developed from Work Plans 2017–2018, Project 3.

1. Colavito, M.M. [Assessment of Community Wildfire Protection Plans in Arizona and the Western US. Southwest Fire Science Consortium](#). Nov. 13, 2019. Webinar. ~40 attendees and 59 views to date on YouTube.
2. Esch, B.E. Metrics of Landscape Restoration Success. Call with USDA Forest Service. Jan. 23, 2020. CFLRP National Coordinators call and webinar. 25 participants.
3. Colavito, M.M., and B.E. Esch. [First Ten Years of the Collaborative Forest Landscape Restoration Program \(CFLRP\) Lessons Learned Peer Learning Session](#). Ecological Restoration Institute, and National Forest Foundation. June 12, 2020. ~45 attendees.

6.1b: Deliverable: Develop and implement two (2) workshops to disseminate science information directly to practitioners.

6.1b.i: Deliverable: Workshop on treatment effectiveness in transitional pine on the Tonto and Prescott national forests. Research dissemination and lessons learned across national forests. This outreach was developed from Work Plan 2018, Project 3.2 and Work Plan 2017, Project 3.2

Esch, B.E., D.W. Huffman, and ERI Staff. Ponderosa pine – Interior Chaparral – Madrean Evergreen Oak Learning Field Trip. For Prescott and Tonto national forests staff. Nov. 14, 2019. 45 attendees

6.1b.ii: Deliverable: Invited symposium for the Biennial Colorado Plateau.

Waltz, A., and W. Covington. “Ecological Restoration in a Changing Climate on the Colorado Plateau: Use of Best Available Science on our Public Lands.” 15th Biennial Conference of Science & Management on the Colorado Plateau & Southwest Region. 8 invited speakers; audience of federal and university researchers, and public land managers. Northern Arizona University, Flagstaff, AZ. Conference session. Sept. 10, 2019. 40 participants.

6.1c: Deliverable: Rapid assessments to support restoration projects at the forest level.

6.1c.i: Two (2) rapid assessment projects (RAPs) to support restoration projects at the forest level.

6.1c.i.1: Mistletoe marking and restoration demo within West Escudilla project (requestors: Apache-Sitgreaves National Forest, Randy Fuller and James Johnston; 4FRI Stakeholder Group).

This project was not completed. The ERI Science Delivery team lost a team member in October 2019; re-hiring was delayed until February, and then unfortunately hit the hiring freeze due to COVID-19. Instead of this demo, additional, significant resources were put toward the 4FRI planning group, where the mistletoe question originated. This group has successfully worked with the 4FRI planning team to better meet the stakeholder group's values with regard to mistletoe management in the 2nd EIS, reducing the need for this proposed demonstration site. However, there is some capacity to address this in combination with the ERI's Mogollon LEARN site, in FY2020 work plan.

6.1c.i.2: Rapid literature review or demonstration for additional Arizona land management agencies.

Esch, B.E. 2020. [An Assessment of Pinyon-Juniper Woodland Classification on the Kaibab National Forest](#). ERI Rapid Assessment Report. General and Technical Reports. Ecological Restoration Institute, Northern Arizona University. 23p.

**6.2 Assist with forest planning and implementation by recommending best available science and program support.** Science and timing of support are variable for each national forest based on each individual forest's planning schedule. This deliverable may include the opportunity to provide Broad-Scale Monitoring Strategy (BSMS) support to the Tonto National Forest, which is just initiating its monitoring plan revision under the 2012 Planning Rule.

6.2a: Deliverable: Report on support.

1. Esch, B.E. Presentation of Kaibab National Forest's Forest Plan plot-based monitoring to Kaibab National Forest team, Ariel Leonard and Valerie Stein Foster. Vegetation data layer and database information request. Oct. 7, 2019. *Presentation*.
2. Esch, B.E. Technical monitoring plan meeting, Tonto National Forest Plan Revision Process. Phoenix, AZ. Feb. 25, 2020. *Technical assistance*.
3. Esch, B.E. Follow up with Robert Madera and Beth Rumpza, Tonto National Forest planners. Prescott National Forest Monitoring Report, Kaibab National Forest Monitoring Report, and BSMS Report provided. Feb. 25, 2020. *Information request*.

### 6.3 Native American outreach program.

6.3a: Deliverable: Report on outreach actions including filling information requests, linking tribes to science, technical resources, needs assessments, and field trips. Meet with or call Susan Rich from New Mexico Energy Minerals and Natural Resources Department (EMNRD) to discuss traditional ecological knowledge (TEK).

1. Martin, J., and H-S. Han. Met with Bureau of Indian Affairs (BIA) and Forest Service personnel to discuss new program at the Intertribal Timber Council annual symposium. June 11–13, 2019. *Needs assessment/information request.*
2. Martin, J. Attend Forest Service National Tribal Relations Managers' Workshop and field trip to Santa Clara Pueblo burned area rehabilitation site. June 18–20, 2019. *Needs assessment/information request.*
3. Martin, J. Meeting with John Waconda to discuss restoration treatment coordination amongst Arizona tribes. July 22, 2019. *Needs assessment/information request.*
4. Martin, J. Attended Forest Service Region 3 Tribal Consultation Meeting with Arizona Tribes. Aug. 13–14, 2019. *Needs assessment/information request.*
5. Martin, J., W. Covington, and H-S. Han. Presented ERI programs to BIA Western Regional Office forestry staff. Sept. 14, 2019. *Needs assessment/information request.*
6. Martin, J., and P. Rappold. Site visit to Cameron Mill to determine location and condition of ICE mill equipment. Oct. 2, 2019. *Needs assessment/information request.*
7. Martin, J., and C.S. Stotts. Alex Becenti, Navajo Forester, request for Brookbank Rapid Assessment Report, delivered Sept. 30, 2019. *Information Request.*
8. Martin, J., and W. Covington. Introductory meetings with Forest Service Tribal Relations, BIA chief forester, and congressional staffers. Oct. 16–17, 2019. *Needs assessment/information request.*
9. Martin, J. Meet and tour Hualapai forest to assess forest conditions and tribal capacity for restoration/research. Nov. 18, 2019. *Field trip.*
10. Martin, J., and P. Rappold. Site visit to Cameron mill site with regional office staff and Cameron Chapter officials to inventory and assess condition of equipment. Jan. 29, 2020. *Needs assessment/information request.*
11. Martin, J. Discussed Forest Service plans for PL 93-638 contracting authorities with Coconino National Forest tribal liaison. Feb. 13, 2020. *Needs assessment/information request.*
12. Martin, J. Discussed action steps to initiate tribal biomass demonstration projects with Gavin Smith, USDA Forest Service Washington Office. May 14, 2020. *Needs assessment/information request.*

**6.4 Provide website science delivery support for ERI, SWERI, and 4FRI (See Project 1 for 4FRI web support).**

6.4a: Deliverable: Redesigned 4FRI website and website maintenance for SWERI and 4FRI.

The 4FRI ([www.4fri.org](http://www.4fri.org)) and ERI ([www.eri.nau.edu](http://www.eri.nau.edu)) websites were fully redesigned in FY2018, and the SWERI ([www.sweri.eri.nau.edu](http://www.sweri.eri.nau.edu)) website was redesigned in FY2019. Regular and routine web updates, including security measures and content maintenance, were performed for all three (SWERI, ERI, 4FRI) sites in FY2019.

6.4b: Deliverable: Report on technical support for ERI, SWERI, 4FRI websites.

Web analytics can be found in the following report enclosure:

- [Project 6.4b. Analytics All Web Site Data Overview ERI – SWERI – 4FRI – FY2019.pdf](#)

**6.5 Edit and deliver biophysical and social-political-economic information for affected entities.**

6.5a: Deliverable: Editorial support for a total of three (3) white papers and/or working papers.

6.5a.i: White paper: Wildfire trends across the western US: Have fires increased in size, severity, and frequency across the western forests?

Wasserman, T.N. 2020. [Wildfire Trends Across the Western US: Forest Fires Have Increased in Size, Severity, and Frequency Across Western Forests](#). ERI White Paper—Issues in Forest Restoration. Ecological Restoration Institute, Northern Arizona University. 10 p.

6.5a.ii: White paper: Assessment of Community Wildfire Protection Plans (CWPPs) in Arizona and throughout the West.

Colavito, M.M. 2020. [Assessment of Community Wildfire Protection Plans \(CWPP\) in Arizona and Throughout the West](#). ERI White Paper—Issues in Forest Restoration. Ecological Restoration Institute, Northern Arizona University. 14 p.

6.5a.iii: Working paper: Fires and soils in frequent-fire landscapes of the Southwest.

Binkley, D. 2020. [Fires and Soils in Frequent-Fire Landscapes of the Southwest](#). ERI Working Paper No. 43. Ecological Restoration Institute, Northern Arizona University. 11 p.

6.5b: Deliverable: Eight (8) fact sheets and “Topics on Restoration and Resiliency” papers that translate and summarize scientific papers and journal articles.

1. Stotts, C. 2019. [Ponderosa Pine Forest Restoration: An Educational Demonstration Site at Fort Tuthill Coconino County Park](#). ERI Fact Sheet. Ecological Restoration Institute, Northern Arizona University. 2p.
2. Esch, B. 2020. [Assessing Metrics of Landscape Restoration Success in Collaborative Forest Landscape Restoration Program Projects](#). ERI Fact Sheet. Ecological Restoration Institute, Northern Arizona University. 2p.
3. Dubay, C.T. 2020. [How the Natural Range of Variability of Frequent-Fire Forests Informs Restoration Treatments](#). ERI Topics in Restoration and Resiliency. Ecological Restoration Institute, Northern Arizona University. 1p.
4. Stoddard, M.T. 2020. [Ecosystem Management Applications of Wildfires in Forests of Grand Canyon National Park](#). ERI Fact Sheet. Ecological Restoration Institute, Northern Arizona University. 2p.
5. Halbrook, J. 2020. [Chip & Ship: Testing the Logistics of Supplying Wood Chips Over Long Distances Using Intermodal Railroad Transportation](#). ERI Fact Sheet. Ecological Restoration Institute, Northern Arizona University. 2p.
6. Huffman, D.W. 2020. [Fire Regimes and Structural Changes in Oak-Pine Forests of the Mogollon Highlands Ecoregion: Implications for Ecological Restoration](#). ERI Fact Sheet. Ecological Restoration Institute, Northern Arizona University. 2 p.
7. Greiner, M. 2020. [Managing for Resilience? Implications of Resilience in Southwestern National Forests](#). ERI Fact Sheet. Ecological Restoration Institute, Northern Arizona University. 2 p.
8. Vaughan, D., D. Auty, and K. Mackes. 2020. [Wood Properties of Southwestern Ponderosa Pine: Implications for Utilization of Forest Restoration By-Products](#). ERI Fact Sheet. Ecological Restoration Institute, Northern Arizona University. 2 p.

## **6.6 Initiate and facilitate knowledge services and science support for non-federal entities through field trips, filling information requests, and presentations for affected entities.**

6.6a: Deliverable: Report on actions to educate and support affected entities. Provide a minimum of ten (10) activities that may include field trips, presentations, and information requests.

1. Dubay, T. Wolfgang Grunberg from the Arizona Department of Forestry and Fire Management (DFFM) requested high-res photos of contemporary doghair thicket vs. healthy PIPO forests for a Story Map on the results of their 2018 Aerial Detection Survey. Photos were provided. July 1, 2019. *Information request*.
2. Dubay, T. Scott Buffon with the *Arizona Daily Sun* requested to speak with someone at ERI about the 4th of July fire that ignited near Chimney Springs, possibly in the 4FRI or FWPP treated area. Contacts and info were provided. July 9, 2019. *Media request*.
3. Colavito, M. “Introduction to the Ecological Restoration Institute.” Environmental and Sustainability Summit Group. Ecological Restoration Institute, Northern Arizona University, Flagstaff, AZ. July 25, 2019. 40 participants. *Presentation/field tour*.



4. Dubai, T., via A. Waltz. Melissa Sevigny with KNAU requested an interview about the Museum Fire with A. Waltz. July 25, 2019. *Media request.*
5. Dubai, T., via A. Waltz. Matt Rodewald with Fox 10 Phoenix requested an interview about the Museum Fire with W. Covington and A. Waltz. July 22, 2019. *Media request.*
6. Dubai, T., via A. Waltz. John Hook with Fox 10 Phoenix requested an interview about the Museum Fire with A. Waltz. Segment aired Sat, July 27. July 25, 2019. *Media request.*
7. Colavito, M., and D. Vosick. Gary Gold with Sen. Kyrsten Sinema's office requested feedback on a letter drafted by Sen. Cantwell to the Chief of the Forest Service in regards to the proposed NEPA changes. Feedback was provided. Aug. 7, 2019. *Information request.*
8. Dubai, T. Ryan Heinsius with KNAU requested the number of treated 4FRI acres for the last few years. Information was provided. Aug. 13, 2019. *Information request.*
9. Colavito, M., and D. Vosick. Field trip with Sen. Sinema and staff at the Ft. Tuthill restoration demonstration site (A. Waltz and H-S. Han also presented). Aug. 15, 2019. 7 participants. *Field trip.*
10. Dubai, T. Peter O'Dowd with NPR's *Here and Now* requested to speak with an ERI ecologist about current forest conditions in the Southwest and particularly California. Contacts were provided. Aug. 20, 2019. *Media request.*
11. Colavito, M., and D. Vosick (and A. Waltz and P. Rappold). Field trip with two staffers from Sen. McSally's office to G.A. Pearson, Museum Fire, and Garland Prairie mill site. Aug. 22, 2019. 6-hour trip. *Field trip.*
12. Dubai, T. Received a request from Ryan Heinsius at KNAU for more information—particularly regarding the carbon footprint and economics—on the chip and ship project, as the national NPR news desk wants to repackage and run his local story. D. Vosick and J. Halbrook provided information. Aug. 29, 2019. *Media request.*
13. Vosick, D. Assisted Paul Summerfelt in presentation on the FWPP and Museum Fire at the Green Room's Thursday night "Science on Tap." Flagstaff, AZ. Sept. 19, 2019. *Presentation.*
14. Dubai, T., via J. Halbrook. Request from Buck Sanchez, Forest Service regional biomass coordinator, for a handout on "Woody Biomass Supply Chain Logistics Using Railroad Infrastructure" for the Bioenergy Day website. Handout was developed and provided. Oct. 7, 2017. *Information request.*
15. Dubai, T., via P. Rappold. Justin Dubail from *NAZ Today* requested information about the Museum Fire closure area, trails, and post-fire recovery work. Oct. 15, 2019. *Media request.*
16. Colavito, C. Request from Mike Browning at Mohave County for information about bark beetles. Provided ERI working papers 30 and 31 and contact information for NAU School of Forestry and RMRS beetle experts. Oct. 16, 2019. *Information request.*
17. Dubai, T. Justin Dubail with *NAZ Today* requested contacts for a video news segment on re-opening trails to the public after the Museum Fire. T. Dubai provided contacts at the Forest Service. Oct. 16, 2019. *Media request.*
18. Dubai, T., via A. Waltz. Kailey Broussard with *Cronkite News* requested information about fire borrowing and the Forest Service budget reports. Oct. 18, 2019. *Media request.*

19. Dubay, T., via NAU Communications. Aristos Georgiou, a reporter with *Newsweek*, requested an interview about the fires in California. Oct. 28, 2019. *Media request.*
20. Dubay, T., via W. Covington. Jim Carlton and Erin Ailworth with the *Wall Street Journal* requested information and an interview on climate-fire relationships and the fires in California. Oct. 29, 2019. *Media request.*
21. Vosick, D. Assistance request by Paul Summerfelt for information refuting assertions by concerned citizen regarding 4FRI. Email had been sent to the Mayor of Flagstaff. Nov. 4, 2019. *Information request.*
22. Dubay, T., via H-S. Han. Parker Shea with the *Arizona Mirror* contacted Han about an interview on small-diameter forest products. Nov. 6, 2019. *Media request.*
23. Colavito, M. "Assessment of Community Wildfire Protection Plans (CWPPs) in Arizona and the Western US." Brown Bag Seminar to the USDA Forest Service Washington Office. Nov. 14, 2019. ~25 participants. *Presentation.*
24. Dubay, T., via Brie Petit (Forest Service). The East Flagstaff Public Library requested 100 4FRI brochures ("Forest Restoration and You") for its public info brochure rack. An ERI student worker delivered them. Dec. 3, 2019. *Information request.*
25. Colavito, M., and D. Vosick. Lucinda Andreani from Coconino County requested the 2018 All-Lands Report. Email was sent with report attached and link to story map. Dec. 11, 2019. *Information request.*
26. Colavito, M. Dylan George-Sills with Logan Simpson requested the CWPP project report. Email was sent with draft report on Dec. 20, 2019 and final report on Jan. 28, 2020. *Information request.*
27. Colavito, M. Chris Bockey with SWCA Environmental Consultants requested the CWPP project report. Email was sent with draft report on Jan. 3, 2020 and final report on Jan. 28, 2020. *Information request.*
28. Colavito, M. Molly Mowrey with Wildfire Planning International requested the CWPP project report. Email was sent with draft report on Jan. 7, 2020 and final report on Jan. 28, 2020. *Information request.*
29. Colavito, M. Anne Mottek with Mottek Consulting requested the CWPP project report. Email was sent with draft report on Jan. 20, 2020 and final report on Jan. 28, 2020. *Information request.*
30. Colavito, M. Caleb Stotts with Chama Peak Land Alliance requested information about the 4FRI modernization work. Email was sent with a link to the workshop website. Jan. 17, 2020. *Information request.*
31. Dubay, T. Lee Ann Beery with Arizona DFFM requested a box of "Restoration for Homeowners" guides, as all of their copies had been distributed. A box was provided. Jan. 21, 2020. *Information request.*
32. Vosick, D. Terry Green Sterling. Requested information about 4FRI in order to apply for a journalism fellowship. Jan. 31, 2020. *Information request.*
33. Dubay, T. Sue North with the Art in Action Gallery in Flagstaff requested informational materials for an upcoming exhibit about restoration on the Colorado Plateau. Materials were provided. Feb. 6, 2020. *Information request.*

34. Dubai, T. Scott Buffon, a reporter with the *Arizona Daily Sun*, emailed to request information on research related to the Museum Fire. Information was provided. Feb. 7, 2020. *Information request.*
35. Dubai, T. Ted McClure, librarian for the Grand Canyon National Park (GRCA) Research Library, requested digital files of the Native Plant Guide to be used by GRCA field researchers only. A pdf of the guide was provided. Feb. 12, 2020. *Information request.*
36. Colavito, M. Jessi Ouzts with the Kaibab National Forest requested information for a community meeting in Parks, AZ, regarding 4FRI treatments in the area. A pdf of the "Restoration for Homeowners" guide and the 4FRI brochure were provided by email. Feb. 12, 2020. *Information request.*
37. Dubai, T. The ERI front desk received a call from Thad Chavez with Forest Service Region 5 in San Bernadino, CA. Mr. Chavez asked if ERI worked in California to conduct rapid assessments. A follow-up was made. Feb. 28, 2020. *Information Request – Note that this information question resulted in a RAP, captured in P6 .1*
38. Dubai, T. Scott Buffon with the *Arizona Daily Sun* emailed about the release date of the Museum Fire survey report. Information was provided. March 4, 2020. *Information request.*
39. Colavito, M. Collin Haffey with TNC New Mexico asked for the CWPP report during the SWERI Cross Boundary Workshop. Report was emailed on March 5, 2020. *Information request.*
40. Waltz, A. Scott Buffon, a reporter with the *Arizona Daily Sun*, emailed to request information on research related to the Museum Fire. Information was provided. July 29, 2019. *Information request.*
41. Waltz, A. Anne Mottek from Greater Flagstaff Forests Partnership (GFFP) requested Museum Fire research information from D. Huffman, and Ft. Tuthill online restoration kiosk information from H. Norton. GFFP meeting at AZ Game and Fish. Aug. 21, 2019, *Information request.*
42. Stotts, C., and J. Springer. Festival of Science Restoration and Plant Walk at Ft. Tuthill restoration demonstration site. Sept. 28, 2019. 7 participants. *Field tour.*
43. Wasserman, T., and A. Waltz. Climate and forests, fire and restoration. Presentation to Flagstaff Climate Leaders. Aug. 29, 2019. 30 participants. *Presentation.*
44. Han, H-S., A. Waltz, and M. Colavito. Presentation to State Leadership Tour, per NAU President Rita Cheng's Request. July 25, 2019. *Presentation.*
45. Waltz, A. Meeting with Travis Woolley to provide ERI update on Chimney Springs spatial heterogeneity paper (C. Stotts production) and deliverable for 2019 working paper. Draft provided. Jan. 13, 2020. *Information request.*
46. Vosick, D., and H-S. Han. Request by Chris Rackens, professional staff for the Subcommittee on Parks, Forests and Public Lands, House Natural Resources Committee for information about small wood industry, capitalization requirements and business profitability. Sent report and synthesized conclusions from a 2015 Report by the Beck Group on Small Diameter Forestry in Eastern, OR. March 24, 2020. *Information request.*
47. Vosick, D. Assistance to provide supporting literature from Cheryl Miller for a \$5 million grant proposal to fund protection of the Centennial Forest. Information provided. March 21, 2020. *Information request.*

48. Dubay, T. Melissa Sevigny from KNAU news radio requested contacts of forestry professors who teach courses with field work. She was curious how they were preparing to incorporate that element during the move to online classes (mandated for the Covid-19 pandemic). March 24, 2020. *Media/information request.*
49. Dubay, T. Karen Malis-Clark, retired Forest Service PIO, called to request a fire history map for a fire education module at Camp Colton. A pdf was provided. April 9, 2020. *Information request.*
50. Colavito, M. Jay Smith with Coconino County emailed to request information about community wildfire risk analyses for a grant application. He was provided with a copy of the All-Lands Report and story map for the Flagstaff area, the CWPP report, and the CWPP white paper. May 18, 2020. *Information request.*
51. Dubay, T. Scott Buffon with the *Arizona Daily Sun* emailed to request an interview with T. Wasserman about her new white paper on wildfire trends across the western US. An interview was scheduled for May 26. May 20, 2020. *Media request.*
52. Colavito, M. Matthew Hamilton with Ohio State University emailed to request information about CWPPs in Arizona for research he is conducting. He was provided with copies of the AZ CWPPs that were collected for the AZ CWPP study and put in touch with DFFM. June 2, 2020. *Information request.*
53. Colavito, M. Steve Horner with Campbell Global asked for information about burn probability on 4FRI. He was provided with the story map to the All-Lands project with Alan Ager and a few other non-ERI resources. June 5, 2020. *Information request.*
54. Crouse, J. Presentation to GFFP. June 18, 2020. ERI web-based fire history map. 12 attendees. *Presentation.*
55. Dubay, T. David Dorum with AZ Game and Fish emailed to request contact info for the person at the Forest Service who is coordinating the effort to provide firewood from 4FRI projects to Hopi and Navajo homes. Contact info was provided. June 24, 2020. *Information request.*

## **6.7 Educate the general public.**

6.7a: Deliverable: Two (2) newspaper articles to educate the general public about the need for forest restoration to restore frequent-fire forests.

1. Buffon, S. 2019. [Mysteries of the Museum Fire scar](#). *Arizona Daily Sun*, Flagstaff, AZ. July 31, 2019.
2. Heinsius, R. 2019. ['Chip and Ship' Project Aims to Speed Up Forest Restoration in Northern Arizona](#). KNAU Arizona Public Radio. Aug. 26, 2019.

## **Project 7. Duty 5 Under the ACT: Provide Annual Progress Reports**

**Complete annual progress report by October 31, 2020.**

This report serves as the final deliverable for Project 7, FY19 Work Plan.